On the other hand, Müller noticed that in the Alps the relative number of Lepidoptera increases, of hemitrope Hymenoptera (short-tongued bees) decreases in the higher parts of the mountains. The influence of altitude upon those two groups of insects is not evident in the Pyrenees.

The Lepidoptera—which in the Alps, according to Müller, are very numerous—are much less numerous in the Pyrenees. All the allotrope insects (Coleoptera, allotrope Diptera, and allotrope Hymenoptera) are relatively more numerous in the Pyrenees than in the Alps. The hemitrope Hymenoptera (short-tongued bees) are somewhat more numerous in the Pyrenees than in the Alps; the hemitrope Diptera (Syrphidæ, Conopidæ, and Bombylidæ) are almost equally represented in both the mountains. The eutrope Hymenoptera (long-tongued bees) seem to be equally numerous in the Pyrenees and in the Alps; in both countries, the humble-bees are predominant, and the not-social long-tongued bees are scarce.

The following table will enable students to compare the flora of the Pyrenees with that of the Alps:—

	Pyrenees.			Alps.	
	Species.	Per cent.		Species.	Per cent.
Pollen flowers (class Po) ...	12	(4·6)	...	14	(3·3)
Fl. with free-exposed honey (class A)	34	(13·0)	...	42	(10·1)
Fl. with partially concealed honey (AB)	45	(17·2)	...	61	(14·6)
Fl. with quite concealed honey (B).....................	37	(14·1)	...	66	(15·3)
Associated flowers with quite concealed honey (B′)	48	(18·4)	...	84	(20·2)
Flowers adapted to bees (Bb)	73	(27·9)	...	110	(26·4)
Flowers adapted to Lepidoptera (Vb)	12	(4·6)	...	39	(9·3)

The allotrope flowers (Po, A, AB) are relatively more numerous, the lepidopterophilous flowers (Vb) are less numerous in the Pyrenees than in the Alps; we have seen that the same differences exist for the corresponding groups of insects.

The hemitrope flowers (B, B′) are a little more numerous in the Alps than in the Pyrenees; the contrary occurs with the hemitrope insects. There is here accordingly no concordance in the geographical distribution between flowers and insects; but the hemitrope insects are not so constant in the choice of their flowers as the allotrope insects and the Lepidoptera; their influence upon the distribution of the corresponding flowers is therefore not so great as that of the two latter groups. The class Bb and the long-tongued bees are nearly equally represented in both the mountains. The parallelism which occurs between the relative abundance of the classes Po, A, AB, Bb, and Vb, and the relative abundance of corresponding insects, agrees very nicely with the theory of flowers.

It may be observed that in the Pyrenees, with reference to the biological floral organization, the Choripetalæ are, on the whole, on a lower level than the Sympetalæ. Only a small number of Monocotyledoneæ could be observed.

University, Ghent. J. MACLEOD.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Council of the Senate have appointed Mr. E. Hill, of St. John's College, to be a governor of Woodbridge School, under the new scheme.

The Harkness Scholarship in Geology and Palæontology has been awarded to Herbert Kynaston, of King's College.

Mr. A. A. Kanthack has been elected to the John Lucas Walker Studentship in Pathology, vacated by the election of Mr. J. G. Adami to a Fellowship at Jesus College. Mr. Kanthack is at present in India as a member of the Leprosy Commission.

The managers of the John Lucas Walker Fund have made a grant of £60 to Mr. E. H. Hankin, Fellow of St. John's, for the purchase of bacteriological apparatus required for his researches.

I. H. Burkill, of Caius College, has been appointed Assistant Curator of the Herbarium.

Prof. Ewing advertises for a demonstrator in mechanism, who has had a workshop training in mechanical engineering. The salary is £150 a year.

The annual report of the Local Lectures Syndicate, published in the *University Reporter* of June 23, records a large amount of useful work in so-called University extension. The number of courses given in 1890-91 was 135, with an average attendance of 10,947. The average attendance at the classes held after lecture was 4916, the number of weekly papers sent in 2266, and the number of candidates examined for certificates 1547. The following passages refer to a fresh departure of considerable interest, and of far-reaching possibilities in the future:—

"The grant for technical education which has been put at the disposal of the County Councils has led to an extension of the work of the Syndicate, and it seems not improbable that if a grant of this nature is made permanent a considerable demand will be made upon their staff of lecturers. In Devonshire they have provided at the request of the County Council a Lecturer on Chemistry and a Lecturer on Mechanics, in each case with special reference to applications to agriculture. The lectures in chemistry were given at six centres, those in mechanics at five. The average weekly attendance was—at lectures about 40, at classes about 25, at each centre. In all, 64 students presented themselves for examination, of whom 44 passed, 14 obtaining distinction. The audience comprised a number of boys from elementary and secondary schools, and some working men and farmers and schoolmasters, in addition to the usual mixed audience. The lectures were of necessity arranged rather hurriedly, without sufficient time for the local authorities to complete their organization, and they can only be regarded as an experiment. The Syndicate have reason to think that the experiment has been as successful as under the circumstances could be expected. . . .

"Having regard to the probability of a considerable demand for lecturers in connection with the County Councils, the Syndicate have added to their list several new lecturers whose attainments mark them out as suitable for this work. And in order that the lecturers may have practical acquaintance with the applications of their science to the uses of agriculture, the Syndicate have arranged that they should pay visits to farms of various characters and to the experimental farm at Woburn. These visits are paid under the experienced superintendence of Mr. H. Robinson, of Downing College, the assistant to the Professor of Chemistry. Mr. Robinson conducts also a course of laboratory work with the lecturers, with special reference to agricultural investigations. The Syndicate desire to express their grateful sense of the help which Prof. Liveing and Mr. Robinson have so liberally given. The provision of teaching and guidance in Cambridge for the scientific study of subjects connected with agriculture appears to the Syndicate to be so important for the training of students who may become lecturers on their staff, that they will endeavour to secure a continuance of this assistance, and are prepared to devote a portion of their funds to the purpose."

The *Ordo Senioritatis* for the year shows that 6 D.Sc. degrees have been conferred, 19 M.D. degrees, 72 M.B., and 70 B.C. These figures bespeak the steady growth of the faculties of science and medicine, the numbers in medicine being larger than in any previous year.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 11.—"On Electrical Evaporation." By William Crookes, F.R.S.

It is well known that when a vacuum tube is furnished with internal platinum electrodes, the adjacent glass, especially near the negative pole, speedily becomes blackened, owing to the deposition of metallic platinum. The passage of the induction current greatly stimulates the motion of the residual gaseous molecules; those condensed upon and in the immediate neighbourhood of the negative pole are shot away at an immense speed in almost straight lines, the speed varying with the degree of exhaustion and with the intensity of the induced current. Platinum being used for the negative pole, not only are the gaseous molecules shot away from the electrode, but the passage of the current so affects the normal molecular motions of the metal as to remove some of the molecules from the sphere of attraction of the mass, causing them to fly off with the stream of gaseous molecules proceeding from the negative pole, and to adhere to any object near it. This property was, I believe, first pointed out by Dr. Wright, of Yale College, and some interesting experiments are described by him in the *American Journal of Science and Arts*.[1] The process has been much used for the production of small mirrors for physical apparatus.

This electrical volatilization or evaporation is very similar to ordinary evaporation by the agency of heat. Cohesion in solids varies according to physical and chemical constitution; thus every kind of solid matter requires to be raised to a certain temperature before the molecules lose their fixity of position and are rendered liquid, a result which is reached at widely different temperatures. If we consider a liquid at atmospheric pressure—say, for instance, a basin of water in an open room—at molecular distances the boundary surface between the liquid and the superincumbent gas will not be a plane, but turbulent like a a stormy ocean. The molecules at the surface of the liquid dart to and fro, rebound from their neighbours, and fly off in every direction. Their initial velocity may be either accelerated or retarded, according to the direction of impact. The result of a collision may drive a molecule in such a direction that it remains part and parcel of the liquid; on the other hand, it may be sent upwards without any diminution of speed, and it will then be carried beyond the range of attraction of neighbouring molecules and fly off into and mingle with the superincumbent gas. If a molecule of the liquid has been driven at an angle with a velocity not sufficient to carry it beyond the range of molecular attraction of the liquid, it may still escape, since, in its excursion upwards, a gaseous molecule may strike it in the right direction, and its temporary visit may be converted into permanent residence.

The intrinsic velocity of the molecules is intensified by heat and diminished by cold. If, therefore, we raise the temperature of the water without materially increasing that of the surrounding air, the excursions of the molecules of the liquid are rendered longer and the force of impact greater, and thus the escape of molecules into the upper region of gas is increased, and we say that evaporation is augmented.

If the initial velocities of the liquid molecules can be increased by any other means than by raising the temperature, so that their escape into the gas is rendered more rapid, the result may be called "evaporation" just as well as if heat had been applied.

Hitherto I have spoken of a liquid evaporating into a gas; but the same reasoning applies equally to a solid body. But whilst a solid body like platinum requires an intense heat to enable its upper stratum of molecules to pass beyond the sphere of attraction of the neighbouring molecules, experiment shows that a very moderate amount of negative electrification superadds sufficient energy to enable the upper stratum of metallic molecules to fly beyond the attractive power of the rest of the metal.

If a gaseous medium exists above the liquid or solid, it prevents to some degree the molecules from flying off. Thus both ordinary and electrical evaporation are more rapid in a vacuum than at the ordinary atmospheric pressure.

I have recently made some experiments upon the evaporation of different substances under the electric stress.

Evaporation of Cadmium.—A U-shaped tube was made, having a bulb in each limb. The platinum poles were at the extremities of each limb, and in each bulb was suspended from a small platinum hook a small lump of cadmium, the metal having been cast on to the wire. The wires were each weighed with and without the cadmium. The tube was exhausted, and the lower half of the tube was inclosed in a metal pot containing paraffin wax, the temperature being kept at 230° C. during the continuance of the experiment. A deposit around the negative pole took place almost immediately, and in five minutes the bulb surrounding it was opaque with deposited metal. The positive pole with its surrounding luminosity could be easily seen the whole time. In thirty minutes the experiment was stopped, and after all was cold the tube was opened and the wires weighed again. The results were as follows:—

	Positive pole.	Negative pole.
Original weight of cadmium	9·34 grs.	9·38 grs.
Weight after experiment	9·25 ,,	1·86 ,,
Cadmium volatilized in 30 mins. ...	0·09 ,,	7·52 ,,

Finding that cadmium volatilized so readily under the action of the induction current, a large quantity, about 350 grs., of the pure metal was sealed up in a tube, and the end of the tube containing the metal was heated to a little above the melting-point; the molten metal being made the negative pole, in a few hours the whole quantity had volatilized and condensed in a thick layer on the far end of the tube, near, but not touching, the positive pole.

Volatilization of Silver.—Silver was the next metal experimented upon. The apparatus was similar to that used for the cadmium experiments. Small lumps of pure silver were cast on the ends of platinum wires, and suspended to the inner ends of platinum terminals passing through the glass bulb. The platinum wires were protected by glass, so that only the silver balls were exposed. The whole apparatus was inclosed in a metal box lined with mica, and the temperature was kept as high as the glass would allow without softening. The apparatus was exhausted to a dark space of 3 mm., and the current was kept on for 1½ hours. The weights of silver, before and after the experiment, were as follows:—

	Positive pole.	Negative pole.
Original weight of silver ...	18·14 grs.	24·63 grs.
Weight after the experiment ...	18·13 ,,	24·44 ,,
Silver volatilized in 1½ hours ...	0·01 ,,	0·19 ,,

In this tube it was not easy to observe the spectrum of the negative pole, owing to the rapid manner in which the deposit obscured the glass. A special tube was therefore devised, of the following character:—A silver rod was attached to the platinum pole at one end of the tube, and the aluminium positive pole was at the side. The end of the tube opposite the silver pole was rounded, and the spectroscope was arranged to observe the light of the volatilizing silver "end on." In this way the deposit of silver offered no obstruction to the light, as none was deposited except on the sides of the tube surrounding the silver. At a vacuum giving a dark space of about 3 mm. from the silver, a greenish-white glow was seen to surround the metal. This glow gave a very brilliant spectrum. The spark from silver poles in air was brought into the same field of view as the vacuum glow, by means of a right-angled prism attached to the spectroscope, and the two spectra were compared. The two strong green lines of silver were visible in each spectrum; the measurements taken of their wave-lengths were 3344 and 3675, numbers which are so close to Thalén's numbers as to leave no doubt that they are the silver lines. At a pressure giving a dark space of 2 mm. the spectrum was very bright, and consisted chiefly of the two green lines and the red and green hydrogen lines. The intercalation of a Leyden jar into the circuit does not materially increase the brilliancy of the lines, but it brings out the well-known air lines. At this pressure not much silver flies off from the pole. At a higher vacuum the luminosity round the silver pole gets less and the green lines vanish. At an exhaustion of about one-millionth of an atmosphere the luminosity is feeble, the silver pole has exactly the appearance of being red-hot, and the volatilization of the metal proceeds rapidly.[1]

If, for the negative electrode, instead of a pure metal such as cadmium or silver, an alloy was used, the different components might be shot off to different distances, and in this way make an electrical separation—a sort of fractional distillation. A negative terminal was formed of clean brass, and submitted to the electrical discharge *in vacuo*; the deposit obtained was of the colour of brass throughout, and on treating the deposit chemically I could detect no separation of its component metals, copper and zinc.

A remarkable alloy of gold and aluminium, of a rich purple colour, has been kindly sent me by Prof. Roberts-Austen. Gold being very volatile in the vacuum tube, and aluminium almost fixed, this alloy was likely to give different results from those yielded by brass, where both constituents fly off with almost equal readiness. The Au-Al alloy had been cast in a clay tube, in the form of a rod 2 cm. long and about 2 mm. in diameter.

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[1] Third Series, vol. xii. p. 49, January 1877; and vol. xiv. p. 169, September 1877.

[1] Like the action producing volatilization, the "red heat" is confined to the superficial layers of molecules only. The metal instantly assumes, or loses, the appearance of red heat the moment the current is turned on or off, showing that, if the appearance is really due to a rise of temperature, it does not penetrate much below the surface. The extra activity of the metallic molecules necessary to volatilize them is, in these experiments, confined to the surface only, or the whole mass would evaporate at once, as when a metallic wire is deflagrated by the discharge of a powerful Leyden jar. When this extra activity is produced by artificial heat one of the effects is the emission of red light; so it is not unreasonable to imagine that when the extra activity is produced by electricity the emission of red light should also accompany the separation of molecules from the mass. In comparison with electricity, heat is a wasteful agent for promoting volatilization, as the whole mass must be raised to the requisite temperature to produce a surface action merely; whereas the action of electrification does not appear to penetrate much below the surface.

It was sealed in a vacuum tube as the negative pole, an aluminium pole being at the other side. Part of the alloy, where it joined the platinum wire passing through the glass, was closely surrounded with a narrow glass tube. A clean glass plate was supported about 3 mm. from the rod of alloy. After good exhaustion the induction current was passed, the alloy being kept negative. Volatilization was very slight, but at the end of half an hour a faint purple deposit was seen both on the glass plate and on the walls of the tube. On removing the rod from the apparatus it was seen that the portion which had been covered by the small glass tube retained its original purple appearance, while the part that had been exposed to electrical action had changed to the dull white colour of aluminium. Examined under the microscope, the whitened surface of the Austen alloy was seen to be pitted irregularly, with no trace of crystalline appearance.

This experiment shows that, from an alloy of gold and aluminium, the gold is the first to volatilize under electrical influence, the aluminium being left behind. The purple colour of the deposit on glass is probably due to finely-divided metallic gold. The first deposit from a negative pole of pure gold is pink; this changes to purple as the thickness increases. The purple then turns to green, which gets darker and darker until the metallic lustre of polished gold appears.

If we take several liquids of different boiling-points, put them under the same pressure, and apply the same amount of heat to each, the quantity passing from the liquid to the gaseous state will differ widely in each case.

It was interesting to try a parallel experiment with metals, to find their comparative volatility under the same conditions of temperature, pressure, and electrical influence. It was necessary to fix upon one metal as a standard of comparison, and for this purpose I selected gold, its electrical volatility being great, and it being easy to prepare in a pure state.

An apparatus was made that was practically a vacuum tube with four negative poles at one end and one positive pole at the other. By a revolving commutator I was able to make electrical connection with each of the four negative poles in succession for exactly the same length of time (about six seconds); by this means the variations in the strength of the current, the experiment lasting some hours, affected each metal alike.

The exposed surface of the various metals used as negative poles was kept uniform by taking them in the form of wires that had all been drawn through the same standard hole in the drawplate, and cutting them by gauge to a uniform length; the actual size used was 0·8 mm. in diameter and 20 mm. long.

The comparison metal, gold, had to be used in each experiment; the apparatus thus enabled me to compare three different metals each time. The length of time that the current was kept on the revolving commutator in each experiment was eight hours, making two hours of electrification for each of the four negative electrodes; the pressure was such as to give a dark space of 6 mm.

The fusible metals, tin, cadmium, and lead, when put into the apparatus in the form of wires, very quickly melted. To avoid this difficulty a special form of pole was devised. Some small circular porcelain basins were made, 9 mm. diameter; through a small hole in the bottom a short length of iron wire, 0·8 mm. in diameter, was passed, projecting downwards about 5 mm.; the basin was then filled to the brim with the metal to be tested, and was fitted into the apparatus exactly in the same way as the wires; the internal diameter of the basins at the brim was 7 mm., and the negative metal filed flat was thus formed of a circular disk 7 mm. diameter. The standard gold pole being treated in the same way, the numbers obtained for the fusible metals can be compared with gold, and take their place in the table.

The following table of the comparative volatilities was in this way obtained, taking gold as = 100:—

Palladium	108·00	Platinum	44·00
Gold	100·00	Copper	40·24
Silver	82·68	Cadmium	31·99
Lead	75·04	Nickel	10·99
Tin	56·96	Iridium	10·49
Brass...	51·58	Iron	5·50

In this experiment equal surfaces of each metal were exposed to the current. By dividing the numbers so obtained by the specific gravity of the metal, the following order is found:—

Palladium	9·00	Copper	2·52
Silver	7·88	Platinum	2·02
Tin	7·76	Nickel	1·29
Lead	6·61	Iron	0·71
Gold	5·18	Iridium	0·47
Cadmium	3·72		

Aluminium and magnesium appear to be practically non-volatile under these circumstances.

The order of metals in the table shows at once that the electrical volatility in the solid state does not correspond with the order of melting-points, of atomic weights, or of any other well-known constant. The experiment with some of the typical metals was repeated, and the numbers obtained did not vary materially from those given above, showing that the order is not likely to be far wrong.

It is seen in the above table that the electrical volatility of silver is high, while that of cadmium is low. In the two earlier experiments, where cadmium and silver were taken, the cadmium negative electrode in 30 minutes lost 7·52 grs., whilst the silver negative electrode in 1½ hours only lost 0·19 gr. This apparent discrepancy is easily explained by the fact (already noted in the case of cadmium) that the maximum evaporation effect, due to electrical disturbance, takes place when the metal is at or near the point of liquefaction. If it were possible to form a negative pole *in vacuo* of molten silver, then the quantity volatilized in a given time would be probably more than that of cadmium.

Gold having proved to be readily volatile under the electric current, an experiment was tried with a view to producing a larger quantity of the volatilized metal. A tube was made having at one end a negative pole composed of a weighed brush of fine wires of pure gold, and an aluminium pole at the other end.

The tube was exhausted and the current from the induction coil put on, making the gold brush negative; the resistance of the tube was found to increase considerably as the walls became coated with metal, so much so that, to enable the current to pass through, air had to be let in after a while, depressing the gauge ½ mm.

The weight of the brush before experiment was 35·4940 grs. The induction current was kept on the tube for 14½ hours; at the end of this time the tube was opened and the brush removed. It now weighed 32·5613, showing a loss of 2·9327 grs. When heated below redness the deposited film of gold was easily removed from the walls of the tube in the form of very brilliant foil.

After having been subjected to electrical volatilization, the appearance of the residual piece of gold under the microscope, using a ¼-inch object-glass, was very like that of electrolytically deposited metal, pitted all over with minute hollows.

This experiment on the volatilization of gold having produced good coherent films of that metal, a similar experiment was tried, using a brush of platinum as a negative electrode. On referring to the table it will be seen that the electrical volatility of platinum is much lower than that of gold, but it was thought that by taking longer time a sufficient quantity might be volatilized to enable it to be removed from the tube.

The vacuum tube was exhausted to such a point as to give a dark space of 6 mm., and it was found, as in the case of gold, that as a coating of metal was deposited upon the glass the resistance rapidly increased, but in a much more marked degree, the residual gas in the tube apparently becoming absorbed as the deposition proceeded. It was necessary to let a little air into the tube about every 30 minutes, to reduce the vacuum. This appears to show that the platinum was being deposited in a porous spongy form, with great power of occluding the residual gas.

Heating the tube when it had become this way non-conducting liberated sufficient gas to depress the gauge of the pump 1 mm., and to reduce the vacuum so as to give a dark space of about 3 mm. This gas was not re-absorbed on cooling, but on passing the current for ten minutes the tube again refused to conduct, owing to absorption. The tube was again heated, with another liberation of gas, but much less than before, and this time the whole was re-absorbed on cooling.

The current was kept on this tube for 25 hours; it was then opened, but I could not remove the deposited metal except in small pieces, as it was brittle and porous. Weighing the brush that had formed, the negative pole gave the following results:—

	Grains.
Weight of platinum before experiment	10·1940
,, ,, after experiment	8·1570
Loss by volatilization in 25 hours	2·0370

Another experiment was made similar to that with gold and platinum, but using silver as the negative pole, the pure metal being formed into a brush of fine wires. Less gas was occluded during the progress of this experiment than in the case of platinum. The silver behaved the same as gold, the metal deposited freely, and the vacuum was easily kept at a dark space of 6 mm. by the very occasional admission of a trace of air. In 20 hours nearly 3 grs. of silver were volatilized. The deposit of silver was detached without difficulty from the glass in the form of bright foil.

Chemical Society, June 4.—Mr. W. Crookes, F.R.S., Vice-President, in the chair.—The following papers were read:—The molecular refraction and dispersion of various substances in solution, by Dr. J. H. Gladstone, F.R.S. The paper is a continuation of that laid before the Society in March last, and deals with solid and gaseous substances that have been dissolved in water and other liquids for examination. The results are given in several tables. In the case of organic compounds, the theoretical and experimental numbers are frequently in close agreement. Hydrogen chloride, bromide, and iodide give figures for the molecular refraction and dispersion much higher than the sum of the hydrogen and halogen as determined from the paraffin compounds, and the values rise as the dilution becomes greater. Selenious and selenic acids afford optical values much less than what would be expected from the known values of their constituents. Metaphosphoric acid does the same. The data relating to solutions of salts and alkalies will afford material for a revision of the refraction equivalents of the different metals, and of the electro-negative elements with which they are combined. Ammonia, in contrast with the hydrides of chlorine, bromine, and iodine, appears to be uniform in its optical properties, whatever the strength of the solution. The refraction equivalents of cerium, didymium, and lanthanum were found about 12·4, 16·4, and 15·5 respectively. The molecular refraction for ClO_3 in its salts dissolved in water comes out at about 18·3, that for BrO_3 at 24·9, and for IO_3 at 33·8.—The nature of solutions as elucidated by a study of the densities, heat of dissolution, and freezing-points of solutions of calcium chloride, by S. U. Pickering. The curves representing these properties were examined in the same way as those for sulphuric acid, and similar conclusions are drawn—namely, that changes of curvature, which occur at certain points which are the same whatever property is examined represent the existence of hydrates in solution. The simplest hydrates indicated consist of $CaCl_2$ with 6, 7, and $8H_2O$; more complex hydrates also exist, as in the case of sulphuric acid.—Note on a recent criticism by Mr. Sydney Lupton of the conclusions drawn from a study of various properties of sulphuric acid solutions, by S. U. Pickering. Mr. Lupton (*Phil. Mag.*, xxxi. 418) applies a single parabolic equation to a portion of one of the author's sulphuric acid density curves, where a change of curvature was supposed to exist, and shows that it represents the results accurately if the experimental error is of a certain magnitude. This magnitude is between 1000 and 10,000 per cent. greater than the ascertained magnitude, and the equation represents all errors of like signs as grouped together. Such a representation cannot disprove the existence of the particular change of curvature under examination, still less that of the 101 others examined by the author. The hydrate on which Mr. Lupton considers that his investigation throws "very grave suspicion" happens to be the one which the author has isolated in the crystalline condition. In the discussion which followed, Prof. Ramsay doubted the validity of Mr. Pickering's methods of differentiating his curves. His own experience was that it was impossible to obtain results nearer than 2 or 3 per cent. to the truth. Dr. Armstrong said that he was prepared to believe in the existence of hydrates in solution, but could not imagine that the 102 breaks in the sulphuric acid curves, for example, could be interpreted as evidence of as many distinct hydrates. He was inclined to think that the breaks might be due to change both in the complex water molecules and the sulphuric acid. He was inclined to believe that the hydrate, to which Mr. Lupton's conclusions related, did not begin to form in solution until the temperature sank to within a few degrees of its point of fusion. Dr. Morley said that a break in the curve should indicate that some new hydrate had just begun to form, but need not show what that hydrate was. Thus, a liquid of the composition $CaCl_28H_2O$ might be expected to contain, besides the hydrate $CaCl_28H_2O$, also higher and lower hydrates, such as $CaCl_29H_2O$ and $CaCl_27H_2O$. Prof. Rücker said that, in reality, Mr. Pickering's results were obtained, not by calculation, but by a method of observation and experiment applied to curves, which themselves represented the results of other experiments. It was admitted that the curves had to be specially drawn, and the scale of the co-ordinates carefully chosen, if the results were to be satisfactory, and probably the conclusions arrived at depended in a large measure on the details of this preliminary adjustment. In the case of the more striking changes in direction and curvature which were clearly visible in the original curve, the various differential curves did not add much to the information it supplied. He thought that the evidence afforded by these secondary curves of changes of curvature, not otherwise detected, was of the most untrustworthy character. Mr. Pickering said that Mr. Lupton's equation represented the rate of change of the densities as a straight line, while the figure which the actually observed rate of change formed was as different from a straight line as possible. The figures here referred to were the first differential figures (rate of change) deduced directly from the determinations themselves; the question of the accuracy attainable in differentiating a graph, raised by Prof. Ramsay, did not apply. He thought that Prof. Armstrong was somewhat rash in holding that a particular hydrate did not exist in solution at moderately high temperatures, because he had recognized it at low temperatures only, especially as he (the speaker) had been led to search for it, and finally to isolate it from results obtained at high temperatures. The multiplicity and complexity of the hydrates indicated must endanger the acceptance of his conclusions amongst chemists; and he was perfectly ready to accept any other explanation of the changes with weak solutions.—Ethylic $\alpha\alpha'$-dimethyl-$\alpha\alpha'$-diacetylpimelate and its decomposition-products, by Dr. F. S. Kipping, and J. E. Mackenzie. This paper contains an account of the preparation and properties of the following compounds: ethylic $\alpha\alpha'$-dimethyl-$\alpha\alpha'$-diacetylpimelate, $\alpha\alpha'$-dimethyl-$\alpha\alpha'$-diacetylpentane, $\alpha\alpha'$-dimethyl-α-acetylcaproic acid, $\alpha\alpha'$-dimethylpimelic acid, and ethylic-$\alpha\alpha'$-dimethylpimelate.—Volatile platinum compounds, by W. Pullinger. The author has studied the volatile compounds of platinum with chlorine and carbon monoxide described by Schützenberger. He describes their behaviour when heated in various gases; as they do not completely volatilize, a determination of the vapour-density was not possible. He describes a non-volatile compound of the formula $PtCl_6.C_2O_2$, and has also prepared the compound $PtBr_2CO$. Directions are given for the preparation of platinic bromide and iodide, from which it appears that spongy platinum readily dissolves in hot solutions of bromine in hydrobromic acid or of iodine in hydriodic acid.

Mineralogical Society, June 16.—R. H. Scott, F.R.S., President, in the chair.—The following papers were read:—On the occurrence of sapphire in Scotland, by Prof. M. Forster-Heddle.—On the optical properties of gyrolite, by Prof. M. Forster-Heddle.—On Fresnel's wave-surface, by L. Fletcher, F.R.S.

Linnean Society, June 18.—Prof. Stewart, President, in the chair.—Mr. W. H. Beeby exhibited specimens of *Hieracium protractum* and other plants collected in Shetland.—Mr. Stuart Samuel exhibited a dwarf specimen of *Acer palmatum*, and made some remarks on the dwarf trees artificially produced by the Japanese.—Mr. R. V. Sherring showed some cases of dried Bananas, and described a new method of preservation adopted in Jamaica to save waste of small parcels of fruit which would be otherwise unsaleable.—Mr. A. W. Bennett exhibited and made remarks upon a specimen of *Selaginella lepidophylla*, which was found to possess remarkable vitality, and upon proper treatment to resume its normal appearance after having been gathered some months.—Dr. R. A. Prior exhibited samples of the Spiked Star of Bethlehem (*Ornithogalum pyrenaicum*), and stated that, although described in British floras as a rare plant, it is so abundant on the hill pastures around Bath that it is brought to the market there in large quantities under the name of French asparagus, and sold for a penny a bunch.—Mr. R. A. Rolfe showed two hybrid *Odontoglossums* with the parent plants—namely, *O. Wilckeanum* (produced from *O. crispum* and *O. luteopurpureum*) and *O. excellens* (produced from *O. pescatorei* and *O. triumphans*). These had first appeared as natural hybrids out of imported plants, and the parentage was subsequently ascertained under cultivation.—On behalf of Sir George Macpherson Grant, Mr. J. E. Harting exhibited some curiously abnormal horns of the Roe Deer (the result of disease), which had been taken from an animal found dead near Forres, N.B. For the purpose of comparison he exhibited some normal heads of the Roe from other parts of Scotland and Germany, and made some remarks on the causes of variation in the size and form of the antlers to which Roe Deer were peculiarly liable.—A paper was then read by Mr. Spencer Moore on the true nature of *Callus*, and in continuation of former remarks on the same subject (Linn. Soc. Journ., Bot., vol. xxvii., Nos. 187–188). He showed that the outer sieve-plates of the fig are obliterated by a substance giving all the dye reactions of *Callus*, which does not peptonize and will not yield proteid reactions. Many of the inner sieve-plates he found to be stopped up with a proteid *Callus* resembling in every way the substance of *Ballia* stoppers, and the proteid *Callus* of the vegetable marrow. It appeared that true *Callus* would dissolve in a solution of gum-arabic, but whether by agency of a ferment or of an acid he had not yet determined.—A second paper by Mr. Spencer Moore dealt with the alleged existence of protein in the walls of vegetable cells, and the microscopical detection of glucosides therein.

PARIS.

Academy of Sciences, June 22.—M. Duchartre in the chair.—Method for the determination of the equatorial co-ordinates of the centres of the plates which are to form the photographic map of the heavens, by M. Lœwy.—On a generalization of equations relating to the theory of the functions of a complex variable, by M. Émile Picard.—On the determination of the mechanical equivalent of heat, by M. Marcel Deprez. At the meeting of June 8, M. Miculesco described an apparatus he had employed for determining the mechanical equivalent of heat. It is now remarked that the same method was employed by Hirn in the experiments made by him in 1860, and in latter years by M. d'Arsonval.—On the formation of the leaves of *Æsculus* and of *Pavia*, and on the order of appearance of their first vessels, by M. A. Trécul.—On the apparent and real glycolytic fermentation in the blood, and on a rapid and exact method of estimation of glycogen in the blood, by MM. R. Lépine and Barral.—On a telephone receiver of reduced weight and dimensions, by M. E. Mercadier.—Observations of the new asteroid discovered at Nice Observatory on June 11, by M. Charlois. Observations for position were made on June 11 and 12.—Observations of the same asteroid made at Algiers Observatory with the telescope of 0·5 metre aperture, by MM. Rambaud and Sy. Observations for position were made on June 12 and 13.—Extraordinary luminous phenomena observed on the sun, by M. E. L. Trouvelot.—On the determination of spiral surfaces according to their linear element, by M. L. Raffy.—On certain systems of spherical co-ordinates, and on the corresponding triple orthogonal systems, by M. A. Petot.—On the damping of Hertz vibrations, by M. V. Bjerknes.—Transmission of light across disturbed media, by M. A. Hurion.—On the electrolysis of barium chloride, pure or mixed with sodium chloride, by M. C. Limb. With moderate currents the author fails to obtain metallic barium; with the pure salt an infusible body of high resistance is deposited; with the mixed salts chlorine is disengaged at the anode, and, from the results of analyses given, it would appear that among the products of the electrolysis some subchloride must be formed.—The calculation of the temperature of ebullition of any liquid whatever, under all pressures, by M. G. Hinrichs.—Action of heat on solutions of chromium salts: green salts of chromium, by M. A. Recoura.—The constitution of the green chromium salts is elucidated by means of the results of experiments following thermochemical methods.—Researches on osmium, osmiamic acid, and osmiamates, by M. A. Joly. Taking the revised atomic weight of osmium, the analyses of Fritzsche and Struve, as well as those of the author, point to $KNOsO_3$, and not to $K_2N_2Os_2O_5$, as the formula denoting the composition of potassium osmiamate. Relations may be traced between osmiamic acid and the nitroso-compounds of ruthenium, $RuNOCl_3$ and $RuNO(OH)_3$. $O{=}OsNO{-}OH$ may be viewed as the first anhydride of the hypothetical $OsNO(OH)_3$.—On the alkaline zirconates, by M. L. Ouvrard.—On the bromo-iodides of silicium, by M. A. Besson.—On the cyanogen compounds of magnesium, by M. Raoul Varet.—On the action of nitric acid of different degrees of concentration upon iron at various temperatures, by MM. Henry Gautier and Georges Charpy. The writers conclude from their experimental results that "*iron is always attacked by nitric acid, whatever its concentration.*" The action may proceed in two ways—(1) rapid, and accompanied by the disengagement of gas; (2) slow, and without evolution of gas. The latter corresponds to what is known as the passive state of iron.—Action of sodium benzylate upon camphocarbonic ether, by M. J. Minguin.—Comparative influences of the sulphates of iron and calcium on the preservation of nitrogen in naked soils and on nitrification, by M. P. Pichard.—On the value of animal *débris* as nitrogenous dressing, by MM. A. Muntz and A. C. Girard.—On the development of blastodermic leaves in Crustaceæ Isopodæ (*Porcellio scaber*), by M. Louis Roule.—On the disengagement of oxygen by plants at low temperatures, by M. H. Jumelle. It appears that in plants capable of resisting excessive humidity or cold the decomposition of carbon dioxide may continue at very low temperatures, even when respiration has ceased. Conifers such as the juniper-tree, and a lichen (*Evernia prunastri*), in light can assimilate the carbon in the air in an atmosphere having a temperature as low as −30° or −40° C.—The parasitic fungi of Acridians, by MM. J. Kunckel d'Herculais and C. Langlois.—On the supposed post-Secondary granites of Ariège, by M. A. Lacroix.—On the age of a porphyritic granite from the Western Pyrenees, by M. Joseph Roussel.—Experimental researches on muscular exertions, by M. Charles Henry.—Diseases of the bones of chimpanzees, gorillas, and orang-outangs, by M. Etienne Rollet.

CONTENTS.

PAGE

Crystallography. By Prof. John W. Judd, F.R.S. . . 193
Photography in Colours. By Prof. R. Meldola, F.R.S. 194
Our Book Shelf:—
Graham: "Geometry of Position."—**Alex. Larmor** 195
Trelease: "The Species of Epilobium occurring North of Mexico."—**J. G. B.** 196
Sargant and Wishaw: "A Guide Book to Books" . 196
Johnston: "Tasmanian Official Record, 1891" . . . 196
Letters to the Editor:—
The Albert University.—**W. T. Thiselton Dyer, C.M.G., F.R.S.** 197
The Holarctic Region.—**Prof. Alfred Newton, F.R.S.** 197
Force and Determinism. (*With Diagram.*)—**Evan McLennan; Prof. Oliver J. Lodge, F.R.S.** . 198
The Scorpions at the Zoo.—**R. I. Pocock** 198
Cetaceans in African Lakes.—**V. Ball, F.R.S.** . . . 198
On some Points in the Early History of Astronomy. V. (*Illustrated.*) **By J. Norman Lockyer, F.R.S.** . 199
The Later Larval Development of Amphioxus. (*Illustrated.*) **By Prof. E. Ray Lankester, F.R.S.** . 202
The Cardiff Meeting of the British Association. By R. W. Atkinson 204
The Marine Biological Association of the United Kingdom 205
University Extension Students at Cambridge . . . 205
Norman R. Pogson, C.I.E. By W. E. P. 205
Notes 206
Our Astronomical Column:—
The Capture Theory of Comets 209
Wolf's Periodic Comet (*b* 1891) 209
Yoruba and Gazaland 209
The Condition of Space. By Sydney Lupton . . . 210
The Flowers of the Pyrenees and their Fertilization by Insects. By Prof. J. MacLeod 211
University and Educational Intelligence 212
Societies and Academies 212